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This report on research studies was compiled in an attempt to analyze, summarize, and disseminate information on the current status of research and development activities in vocational, technical, and pratical arts education. In the five-state Upper Midwest Region (Iowa, Minnesota, North Dakota, South Dakota, Wisconsin) a priority list of mutual, current, significant occupational education problem areas was identified. This report summarizes the research in terms of the progress it represents on the research problems outlined in the priority lists. The report also points out desirable future directions which research efforts might profitably pursue in light of last research. The summaries of the research are grouped under the areas of: (1) Philosophical and Social Framework, (2) Manpower Supply and Demand, (3) Curriculum Development, (4) Techniques and Modes of Instruction, (5) Career Development, (6) Organization Administration, (7) Staffing, and (8) Program Evaluation. Recommendations were: (1) Researchers must become more aware of the broad problem areas, (2) More adequate numbers of researchers are needed and schools should assist by making more time available, and (3) Better dissemination of research results must be done if the research effort is to be coordinated. (MM)

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September 1968

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INTRODUCTION

This report on research studies which have been, or which were in the process of being conducted in Minnesota between 1965-'67 has been compiled by the Minnesota Research Coordination Unit in an attempt to analyze, summarize, and disseminate information on the current status of research and development activities in vocational, technical, and practical arts education.

The report has drawn heavily upon a prior bibliography compiled by Editha Jiloca as a staff study for the Minnesota Research Coordination Unit, and upon a Masters Plan B paper reviewing research in occupational education in Minnesota written by Lyle Faurot and conducted with the support of the Research Coordination Unit.

A goal of research in occupational education is to provide a systematically derived body of knowledge upon which decisions for change in the educational enterprise (e.g., school systems, curricula, methods of instruction) can be based; development activities can be undertaken for the purpose of designing the methods, means or format for accomplishing the desired change. In order for research and development to accomplish these tasks, it is assumed a) that the effort must be cumulative or additive (e.g., that significant change is seldom based upon the findings of any one study or report), b) that it must have direction (e.g., that in order for accumulation of a body of knowledge to occur, a common goal must be specified in advance), and c) that the results of research and development must be readily accessible, available and understandable to all who are likely to be involved in educational decision-making and change.

In the five-state Upper Midwest Region (Iowa, Minnesota, North Dakota, South Dakota, Wisconsin) a priority list of mutual, current, significant occupational education problem areas has been identified. The list was developed by selected representatives of the five-state region's major resources for research and development in occupational education. In Minnesota, a similar kind of problem area list has also been compiled by the Advisory Committee for the Research Coordination Unit. These lists a) represent the problem areas where R & D activities are felt to be most critically needed and in which change in the educational process seems to be most desirable, and b) provide the necessary direction and common goals in order for R & D efforts to be cumulative and of maximum usefulness in the decision-making process regarding program development.

The report summarizes the research in occupational education in terms of the progress it represents on the research problem areas mentioned above. The problem areas have arbitrarily been classified under eight major aspects of occupational education (See A to I, p. 4 to 10). In this sense, the report is a summary of past and current research activity, and a review of the present state of occupational research in Minnesota.

In addition, the report points out desirable future directions which R & D efforts might profitably pursue in light of past research, the major problem areas which still remain relatively unexplored at the present time, and the general availability or accessibility of the reports of research and their findings.

In this sense, it is expected that the present report will serve as a reference source and/or guide for interested researchers in the state and region, and for individuals who are in positions to influence the research directions of others.

Finally, a part of the report presents a brief review of available studies in occupational education which have been grouped and reviewed in terms of the eight aspects of occupational education. Several of the implications of these studies have been suggested for each of the eight categories.

The staff of the Research Coordination Unit sincerely hopes this reference report will help to improve and guide the immediate and long-range research and development effort in vocational, technical, and practical arts education in Minnesota.

A COMPARISON OF RESEARCH NEEDED AND COMPLETED

PROBLEM AREAS	Number of Studies Completed or In Process In Minnesota, 1965-'67	Number of Those Studies Available for Review
A. Philosophical and Social Framework		
What types of vocational education should be provided at (a) the secondary level, (b) at the post-secondary level, and (c) how should these be articulated?	3	3
What happens to persons not able to attend existing post-high school institutions?	1	
What part should the expressed occupational interest of potential students play in developing vocational programs?	4	
How effective are youth club organizations and activities?		
What is the most effective means for encouraging educational innovation based upon the results of research?		
What factors are influential in developing and changing attitudes toward "work" and its role in society?	4	1
Other Studies	11	3
	23	7 (16)

While there has been an attempt to deal with several of the problem areas in this group a) most of the studies conducted or in process can be placed in the "other" category (presumably, they do not contribute directly to the solution of identified problems), b) there is a substantial discrepancy (16 studies) between the number of studies reported and the number of studies generally available (that is, for 16 of the studies, reports are not accessible to other interested educators and/or researchers in the various department libraries at the University).

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[1]The list of problem areas has been drawn from the report by Moss, Report of a Five-State Occupational Education Research and Development Planning Conference.

	Number of Studies Completed or In Process In Minnesota, 1965-'67	Number of Those Studies Available for Review
B. Manpower Supply and Demand		
What factors effect the geographical mobility of our potential trainees and graduates?	1	
How can the nature and rate of emerging occupations, and major qualitative changes in existing occupations, be forecast?	5	1
What are the current and predicted quantitative needs for occupational training in the region?	5	4
What procedures should be used to predict the numbers of persons who are likely to desire vocational training (Pre-employment, retraining, upgrading and updating) during a given period of time regardless of occupational demand?		
What are the educational specifications for maximally useful occupational projections (e.g., what is our geographical area of concern, occupational fields and levels of concern, specificity of occupational designation, length of forecast period, allowable error of prediction)?		
What factors influence the employer's selection of employees? How do these differ from realistic job requirements? What mechanism can improve the selection process? (e.g., effect of age, discrimination and bias, inadequate communication, unions, licensing requirements, patronage, influence of placement services.)	11	1
Other Studies	3	
	25	6 (19)

Some concern among researchers for problems related to manpower supply and demand is evident. Much of the research undertaken has been directed toward previously identified problem areas with relatively few studies in the "other" category.

C. Curriculum Development		
What is the relative effectiveness of different kinds of: (a) pre-vocational education, (b) work experience, and (c) vocational programs on subsequent occupational success and satisfaction?	5	

	Number of Studies Completed or In Process In Minnesota, 1965-'67	Number of Those Studies Available for Review	
How can we standardize occupational curriculums? (a) what are the common elements within occupations and/or between occupations in the region? (b) what type of organization is needed to develop, organize, and disseminate standard curriculums for the region?	4	2	
What type of occupational education program can we develop in our relatively small secondary schools to prepare students that are low in ability, interest, and motivation for employment?			
What programs should be offered to those who are "screened out" of existing vocational programs?	1		
By what systems has the present work force gained job competencies? (e.g., apprenticeship, on-the-job, public schools.)			
What is the nature of prior educational and other experiences which best facilitates subsequent pre-employment vocational instruction?	4	2	
What is the relative efficiency and effectiveness of each of the systems for gaining job competencies? (e.g., economic, sociological, political benefits and costs.)			
Other Studies	32	8	
	46	12	(34)

Although a highly researched group (46 studies completed or in process), most of the studies in this problem area are not available (almost 3/4 of the studies are unavailable). Of the research completed, 70% is in the "other" category, which is comprised of the development of curriculum guides and courses of study for local school systems.

D. Techniques and Modes of Instruction

To what extent should content for immediate vs. long-range career goals be emphasized? At what level of generality should selected content be provided? What principles of content organization and arrangement maximizes its transfer value?	7		
Other Studies	31	27	
	38	27	(11)

	Number of Studies Completed or In Process In Minnesota, 1965-'67	Number of Those Studies Available for Review

A unique aspect of the studies in this group is that relatively large numbers completed are also available to researchers (27 out of 38 studies). Much of the research concerning instructional methods ("Other") is of the experimental type, utilizing treatment and control groups and comparing the relative efficiency and/or effectiveness of different teaching methods, and comparing different audio-visual modes of instruction. Some studies attempt to apply and investigate various theories from the psychology of learning.

E. Career Development

How and at what educational level(s) can we develop in the student: (a) appropriate work values, (b) receptive attitudes toward change, (c) awareness of personal abilities and interests and how they relate to the world of work, and (d) familiarity with occupations and careers which will provide a basis for making realistic career decisions when and as they need to be made?	21	4
What levels and kinds of individual characteristics (e.g., interests, aptitudes, attitudes) which students bring to vocational programs lend themselves to: (a) efficient training for various occupational groups, and (b) effective subsequent job performance in various occupational groupings?	23	5
To what extent would controlled experience in business and industry for counselors and non-vocational teachers assist them in helping youth make more realistic educational and vocational choices?		
What factors influence labor force participants and the formation of career development patterns? (e.g., values, work experience, initial failure, formal guidance efforts, social class, education, family influence.)	10	1
How can dropouts from H.S., colleges, and universities be helped to (a) reassess their educational and vocational goals, and (b) enter the work world with marketable occupational skills?	8	
What standards and procedures should be used in analyzing the qualitative aspects of various occupational groupings in order to determine their technical, psychological and sociological requirements for job satisfaction and satisfactoriness.	1	1

	Number of Studies Completed or In Process In Minnesota, 1965-'67	Number of Those Studies Available for Review	
Other Studies	31	1	
	94	12	(82)

The most highly researched group of problems in vocational-technical education deals with Career Development. The completed studies in this group appear to be relatively evenly divided among the problem areas. The number of studies available to researchers, however, is discouragingly low (approx. 13%). Of the 94 studies completed, 82 studies are unavailable. The bulk of this research effort would appear to be largely wasted in the sense that other researchers will continue working "in the dark" with much needless repetition of prior effort.

F. Organization and Administration

Are comprehensive post-secondary institutions more efficient organizations for providing vocational programs than specialized institutions?			
What changes are needed in vocational and technical education programs to help students, who withdraw before completion, to make better use of their education in obtaining employment?			
What is the most efficient administrative pattern and organization within a school district for operating area vocational and technical schools?	1		
What is the nature and extent of the vocational training which industry is willing and able to provide?	1	1	
Other Studies	8	4	
	10	5	(5)

The fewest number of studies has been conducted on the organization and administration of vocational-technical schools. Investigation of problems in this group are a) not formally conducted investigations with final reports prepared and made available, b) highly localized investigations, the results of which are not widely disseminated, and knowledge of which is, therefore, difficult to get, or c) have not generally been undertaken.

	Number of Studies Completed or In Process In Minnesota, 1965-'67	Number of Those Studies Available for Review
G. Staffing		
What are the most satisfactory techniques for recruiting, selecting, preparing, updating and utilizing vocational instructors? (a) What occupational and professional competencies are needed by vocational instructors to perform satisfactorily? (b) How can individuals with occupational competence be encouraged to obtain the professional education needed to perform satisfactorily as teachers? (c) What are the direct and indirect values of requiring work experience, and how long should this experience be? (d) Can cooperative work-study experiences provide adequate occupational competence and values?	12	4
What programs can best serve to recruit, select and train specialists in vocational education? (e.g., administrators, researchers, counselors, supervisors.)		
Other Studies	11	4
	23	8 (15)

Recruiting, preparing and updating staff for the vocational-technical schools in Minnesota has been investigated. Half of the completed studies center on particular problem areas, while half (in the "other" category) deal largely with psychological and personality characteristics of teachers and student teachers in the vocational, technical and practical arts fields.

H. Program Evaluation		
What are the economic, sociological, and psychological criteria for evaluating the success of vocational programs? (a) How can these be measured most validly and reliably? (b) What data collection system should be developed to permit continuous program evaluation? (c) Can criteria and instruments be developed to satisfy institutional self-study as well as "other agency" needs?	6	3
How can the economic return to society of training for a given occupation be computed?	3	
What are the criteria for evaluating the quality of vocational-technical school programs?	1	

	Number of Studies Completed or In Process In Minnesota, 1965-'67	Number of Those Studies Available for Review
What educational arrangements will increase the internal efficiency and effectiveness of each vocational-technical school program (using criteria above)?	7	
a. Administrative practices and organizational arrangements		
b. Selection and organization of substantive content	2	2
c. Modes of presentation and instructional facilities	1	1
d. Procedures and services for increasing information about and the appropriateness of educational and occupational choices		
Other Studies	29	11
	49	17 (32)

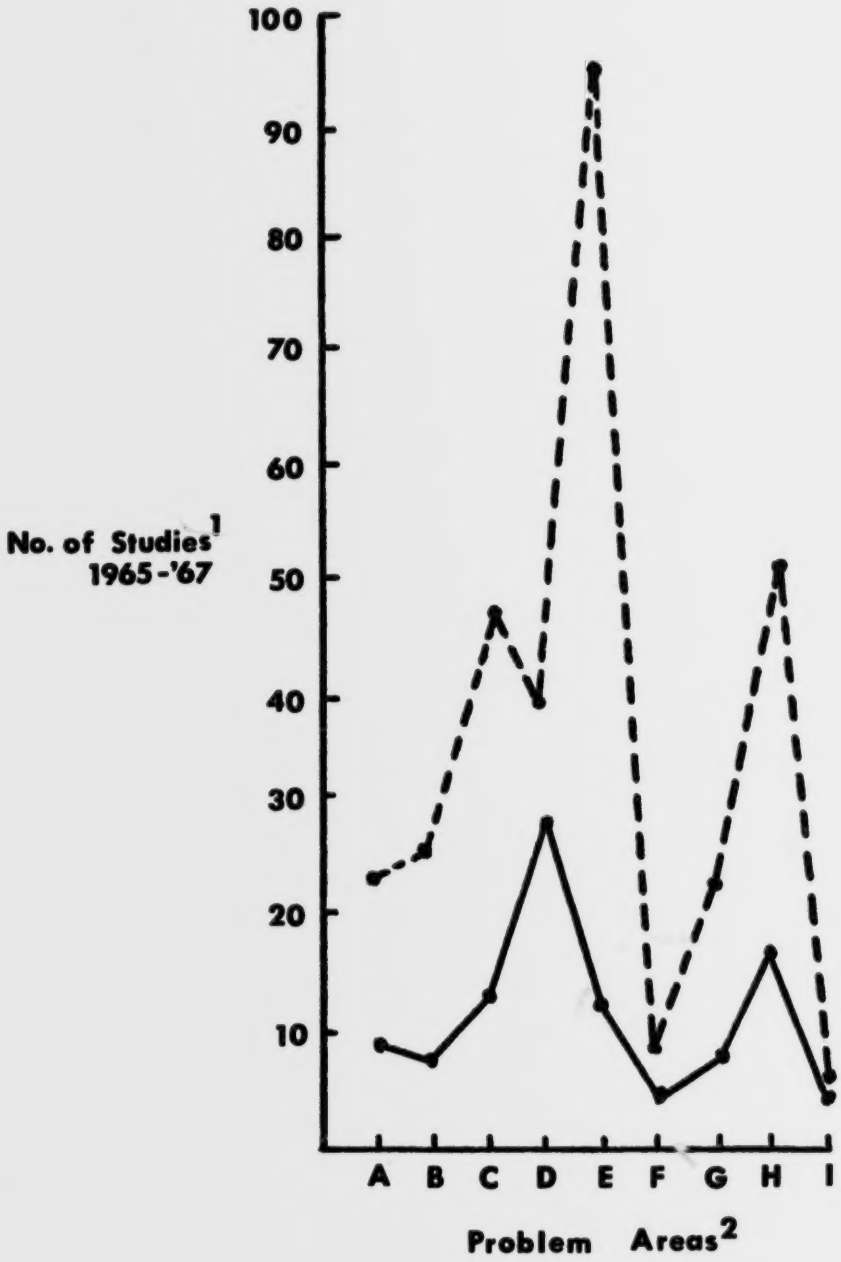
Approximately half of the studies evaluating the effectiveness of curricula and courses of study are follow-up efforts of graduates of particular schools and/or curricula (e.g., business majors, agriculture students) and have been included in the "other" category. Many of the reports of follow-up studies are not widely circulated, but it is likely that particular schools have reports of their own studies. The available reports reflect a variety of techniques and procedures useful for the conduct of follow-up studies.

I. Miscellaneous	5	4
	5	4

These were studies dealing with methods of research, aspects of vocational education of other countries, and financial aspects of vocational fields.

Figure 1

A Comparison of Number of Studies Completed and Number Available



1 - Based upon studies reported in Jiloca, E., Bibliography of Studies In Occupational Education Conducted In Minnesota: 1965-'67, Minnesota RCU.

2 - Classification of problem areas used by Faurot in a Masters Plan B paper reviewing available studies in occupational education.

A= Philosophical & Social Framework
B= Manpower Supply & Demand
C= Curriculum Development
D= Techniques & Modes of Instruction
E= Curriculum Development
F= Organization & Administration
G= Staffing
H= Program Evaluation
I= Miscellaneous

---- Total No. of Studies Per Problem Area (Jiloca)
———— Studies Currently Available (Faurot)

Figure 1 points out the obvious discrepancy, in every category, between the studies completed in 1965-'67, and the studies available to researchers in Minnesota. For example, of the 94 studies completed which treat problem areas related to the Career Development aspect of vocational-technical education, 12 of these studies are available to researchers in vocational department libraries at the University of Minnesota; 82 studies are unavailable. Although a more extensive research effort has been made on problems related to Career Development than on any other problem area, the results of most of this work are not generally available or accessible to other interested researchers.

Other well-researched problem areas are those of Curriculum Development (46 studies completed or in process in 1967) and Program Evaluation (49 studies). The figure shows that while the category of Manpower Supply and Demand is one of the least researched categories, (in terms of total number of studies completed), most of the studies undertaken have been directed at particular problem areas within the category. The category with the least research is that of Organization and Administration (9 studies).

A SUMMARY OF FINDINGS AND IMPLICATIONS OF COMPLETED RESEARCH

A. Philosophical and Social Framework

Halvin formulated a modern philosophy of vocational education based on a review of the philosophical and historical background of vocational education and a review of the provisions of the National Vocational Education Acts. The philosophy called for vocational offerings in the public schools to meet the needs of each individual in developing his full potential (Halvin, 1965).[2]

In an investigation of the "Source and Extent of Economic Commitments to Public Vocational Education in Minnesota and Their Effects on the Nature of Training Opportunities", Nelson found large wealth variations among school districts in terms of adjusted assessed valuation per pupil, with the wealthier districts offering relatively more vocational training opportunities. The author suggested the need for studying the possibility of allocating federal funds for vocational education to local school districts on an equalization basis (Clifford Nelson, 1966).

In a study of agricultural education in Greece, Vassiliou concluded that the farmer needed more education, both vocational and general, in order to enjoy a reasonable degree of economic success (Vassiliou, 1965).

Netwas summarized the developmental history of the School of Home Economics in terms of its inception, organizational pattern, relationship to other units within the university, relationship to groups outside the university, role and function, curriculum, space and facilities, staffing, policy making, and growth (Netwas, 1966).

Lackore recorded the procedures followed in the establishment and development of the Business Department in the Winona Area Vocational-Technical School and evaluated the students of the first four stenography classes. Progress in shorthand and typewriting was found to be positively related to age and previous training. Students over thirty with no previous training did not make satisfactory progress in typewriting (Lackore, 1966).

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[2]Refer to entries in the review study be Faurot cited in the bibliography of this report.

IMPLICATIONS: These studies agree on the need for expanded offerings in vocational education. Further study is needed to determine (a) the appropriate setting for this type of training, (e.g., in the public high school, area vocational school, junior college), and (b) the most beneficial method for distributing federal funds for vocational education.

The studies by Netwas and Lackore offer valuable insights for educators developing new programs in the home economics and business fields.

B. Manpower Supply and Demand

Three surveys of off-farm agricultural employment opportunities were conducted by Lauer, Reynolds, and Hartog. Lauer found the off-farm opportunities good in Anoka County, Minnesota. He indicated the need for competence in both agriculture and business and recommended that the vocational agriculture department offer a course in "agri-business" (Lauer, 1965).

In Polk County, Wisconsin, Reynolds indicated the largest expansion in off-farm agricultural business is anticipated in the areas of dairy processing and machinery sales. Employers considered the ability to sell and customer relations the most important abilities in employees. This study also revealed a need for training in business management (Reynolds, 1967). Hartog surveyed twenty-three different types of businesses in Kandiyohi County, Wisconsin, and found agricultural competencies needed in almost every field investigated (Hartog, 1965).

In St. Louis County, Minnesota, White uncovered a wide variety of job opportunities in the field of forestry. The study pointed out the need for forestry and conservation training in the vocational agriculture programs in forestry oriented geographical areas, such as St. Louis County. White noted the availability of advanced education in this field in the junior colleges and post-high schools (White, 1967).

A study by Brunner provided an occupational picture of Wood County, Wisconsin. Brunner concluded that (a) schools need to continue providing education and training for the purpose of upgrading employees, (b) most employers preferred employees with at least one or two years of vocational or technical training, (c) two-thirds of the job openings have existed for one month or more, and (d) there is a considerable need for training prior to initial employment (Brunner, 1965).

Timpany's survey of the distributive occupations in Manitowoc, Wisconsin, revealed the need for a full-time two year marketing course at the Manitowoc Technical Institute. The city of Manitowoc alone had enough job openings in the distributive field to provide employment for the graduates of such a course (Timpany, 1967).

Mills established the need for a two-year med-management program in horticulture at the Kenosha Technical Institute, Kenosha, Wisconsin. It was found that over ninety percent of the responding employers in the horticulture field train their own employees using "on the job" training techniques. About eighty percent of these employers indicated they would hire trained people if they could, and some would expand their businesses if trained employees were available (Mills, 1966).

IMPLICATIONS: There seemed to be an abundance of off-farm agricultural opportunities for those with appropriate training. Two studies (Lauer, Hartog) explicitly pointed out the need for more business training for agricultural employees. The need for certain types of courses in particular areas was established by four of the studies (White, Timpany, Brunner, Mills).

C. Curriculum Development

Studies to Determine the Need for Specific Kinds of Content:

As a result of an investigation of needed curriculum changes in vocational agriculture in Rosemount, Minnesota, Monson advocated that the high school agriculture programs be altered by adding (a) general agriculture courses, (b) courses for vocational and avocational interests, and (c) courses which are a combination of general and vocational courses (Monson, 1965).

A similar study at Faribault, Minnesota reported a need for increased emphasis on adult education and a need to increase the breadth and diversity of vocational agriculture courses for young farmers in the Faribault area (Statesbery, 1965).

Kajer studied Agricultural Education Extention Programs in developing areas. He was convinced that we must transmit knowledge rather than just information, introduce ideas rather than gadgets, and change attitudes rather than force a different system on the farmers of developing nations (Kajer, 1965).

Hasslen cited the following advantages for a proposed three-track program for teaching agriculture in the Rush City High School, Rush City, Minnesota: (a) Courses are named in order to foster more clearly defined content, (b) course content presented as it occurs in technical education is better preparation for high school agriculture students who go on to college, (c) there is a greater variety of courses in the upper years of school, and (d) the increased flexibility and enrollment in agriculture should lead to more efficient use of resources (Hasslen, 1965).

In an appraisal of needed curriculum changes in industrial arts at Buffalo, Minnesota, Johnson found the need for expanded facilities and courses, especially in electronics, power mechanics and machine shop (Dean Johnson, 1966).

Koester provided justification for discontinuing cabinetmaking at the high school level in favor of increasing enrollments in post-high school cabinetmaking at the Minneapolis Vocational High School. His study showed that there is a significant difference in the attitudes and achievements of students favoring the post-high school students (Koester, 1967).

Kost studied the need for consumer and economic education for all high school students in Minnesota. He reported a lack of support for consumer education on the part of most business teachers. Most supervisors and non-business teachers also do not fully understand the need for this type of education (Kost, 1965).

Studies on Specific Content:

In the area of industrial education, several studies were conducted to determine the appropriateness of specific content as the basis for further curriculum development.

In a thorough study of classical Greek furniture design, Bingham found that the design of classical Greek furniture is quite compatible with modern trends in furniture design and would provide appropriate content in a design course (Bingham, 1965).

Changes in the teaching of drafting were suggested on the basis of a survey of St. Paul Junior and Senior High School drafting teachers (Fisher, 1966), and a study of drafting practices in industry in the Minneapolis-St. Paul area (Lind, Jerecaek, 1966). Fisher provided a suggested outline of subject matter for a junior high course in drafting. Lind and Jereczek reported that high school drafting lags behind industrial practice and needs to be updated.

Erdman identified mathematical operations used in drafting, metalworking, and woodworking at the ninth grade level. He reported a lack of application of mathematics to industrial arts types of problems in the 7th, 8th, and 9th grade textbooks. The study indicated most industrial arts students have a limited mathematics background beyond the ninth grade level. Erdman recommended a concerted effort on the part of educators to correlate their particular subject with the total curriculum (Erdman, 1966).

Studies To Develop Written Materials:

A number of studies were conducted to produce textbooks, teaching guides, laboratory manuals, and other written materials.

Skoog demonstrated the feasibility of adapting the methods and procedures of modern mathematics to the arithmetic content necessary for trade and technical education. A result of the study was a mathematics textbook, "Mathematics For Technology: An Arithmetic Textbook For Students In Trade And Technical Education" (Skoog, 1966).

A survey of Twin City electronic instructors revealed a need for a comprehensive manual for a beginning senior high school electricity course. To meet this need, Rahn and Magnuson produced "A Student Laboratory Manual For Senior High School Electricity" (Rahn, Magnuson, 1966).

A curriculum developed by Rivers, "Electricity-Electronics For The White Bear Lake Secondary Schools", embraces both junior and senior high school levels, including a full two-year program of industrial arts electricity-electronics in the senior high school (Rivers, 1966).

Larson developed a teaching guide, "An Approach To Teaching Low Temperature Casting On The Junior High School Level". His study also detailed the equipment, materials, and resource information needed for teaching such a unit (Larson, 1965).

"A Correspondence Study Guide In Typewriting" teaches the student the operation and mechanical features of the typewriter, and is designed to help the student learn to type with speed and accuracy. Included in the guide are problems in centering, tabulation, manuscripts, letters, envelopes, and postal cards (Gudahl, 1965).

Through a survey of book companies and bookkeeping machine sales representatives, Carr determined the need for an instruction manual for the bookkeeping machine. The manual is intended for use in teaching the operation of the bookkeeping machine only (it is not an accounting manual). Carr's manual is not a self-study course, but is designed for use in technical school classes with competent instructors (Carr, 1965).

Skare contributed to upgrading instruction in agricultural supplies and machinery retailing through the development of a set of case problems, "Case Problems In Agricultural Supplies and Machinery Retailing". Skare indicated the case problems were enjoyed by the high school students when used carefully to supplement other teaching methods. The problems provided the students with an opportunity to apply previously learned facts and theories (Skare, 1967).

IMPLICATIONS: Recent studies indicate a need for a greater variety of course offerings and teaching approaches in agriculture. More emphasis on adult education in agriculture would be very helpful to young farmers getting started. Studies in the area of industrial education have identified content needed to upgrade courses in drafting, design, and technical math. Other educators may find the textbooks, teaching guides, and lab manuals helpful in their own programs.

D. Techniques and Modes of Instruction

Teaching Aids:

Renner developed a visual-manual-graphical teaching device using the fluid power symbols adopted by the International Organization for Standardization. The symbols attach to a baseboard to build up fluid power schematics. Raters considered the device as effective as the chalkboard. The teaching aid was developed for teaching fluid power in industrial arts, vocational, and technical programs (Renner, 1966).

A training device for teaching selected digital computer concepts was developed and evaluated by Backstrom. Statistical tests showed there was no significant difference in results when teaching with the teaching device and when teaching by a conventional method. The total results seemed to indicate the training device was helpful in the learning process (Backstrom, 1966).

Steele compared two types of equipment for teaching plastics concepts. The study revealed that commercial plastics equipment seemed to produce better results than educational toys. He hypothesized that the commercial equipment resulted in greater motivation (Steele, 1967).

A set of transparencies, by Anderson, for teaching economic concepts at the upper elementary level should provide teachers with a new source and may suggest a novel approach to the teaching of social studies related to the state of Minnesota (Roland Anderson, 1966).

Bjorkquist compared the effectiveness of scale-models and pictorial drawings in teaching orthographic projection. The results of this study have suggested that it is difficult for beginning students to interpret three-dimensional objects in terms of two-dimensional orthographic projections. It has also shown that it was considerably easier for students to make the interpretation from two dimensional pictorial drawings to two dimensional orthographic drawings (Bjorkquist, 1965).

Teaching Materials:

Ten selected enamel finishes were experimentally compared to determine their suitability for use in industrial arts courses. Comparisons were made with respect to method of application, equipment necessary for application, volatility, availability, and cost. Johnson reported that four of the ten brands were superior, and one of these outperformed the other nine brands in six of the seven tests used to measure resistance to various kinds of abuse (Howard Johnson, 1965).

Gohl explored the relationship between a standard ripsaw as used in industry and the size of beginning industrial arts students, to determine whether better results could be obtained by shortening the length of the saw according to the height of the student. Lack of significant results was attributed to small sample size (Gohl, 1965).

In a content analysis of selected home economics textbooks, Ringsmuth evaluated their coverage of the art elements (line, color, and texture) in clothing. Secondary clothing tests place more stress on color than the other elements (Ringsmuth, 1965).

An abundance of free and inexpensive materials for use in business education classes is available from business organizations, government agencies, and other sources. Jensen listed materials in the areas of life and health insurance, money and banking, the stock market, advertising, and taxes (Jensen, 1967).

Teaching Methods:

Saksa studied the efficiency of the radio as a method of influencing the people of Itasca County. He concluded that the radio is an effective means for influencing people as measured by responses to the extension programs presented on the radio (Saksa, 1966).

In a comparison of educational films and industrial visits as methods for teaching about the woods industry, Kinning reported the 16mm film was more effective than the industrial visit (Kinning, 1965).

Pucel checked on the relative effectiveness of three methods of organizing information sheets for vocational courses. The information sheets were compared on two difficulty levels, moderately difficult (metalworking applications of the laser) and difficult (communications applications of the laser). No significant differences in the effectiveness of the three methods were noted at either difficulty level (Pucel, 1966).

Pratzner investigated the effectiveness of an auto-instructional program in teaching seventh grade beginning drafting students. The program seemed to be effective in teaching the cognitive content of certain drafting techniques, but was less effective for teaching the manipulative portion of the drafting techniques (Pratzner, 1965).

A framework for research in industrial arts motor learning was developed by Nelson; the psychomotor learning system involves four variables: learning environment, input, learner, and performer. The framework was presented as a conceptual system to be used in identifying problems for further research in motor learning (Orville Nelson, 1967).

Sanders compared the withdrawal strength of various fastening devices in five types of wood as a basis for an experimental project in industrial arts classes. He concluded that this type of experiment would be an effective learning experience and could be added to the industrial arts program with relatively little effort (Sanders, 1965).

Testing an experimental unit on human relations with junior high school students, Fore found the unit helps encourage self acceptance, development of ego strength, acceptance of others, and social values (Fore, 1965).

Gabrielson experimented with a beginning lab course in clothing construction at the college level. The study showed the experimental lab method to be significantly superior to the conventional method as measured by pretest-postest gain scores (Gabrielson, 1966).

Using a non-computer based business game in teaching business problems courses at the post-high level, Ashmun discovered the game approach was not significantly better than the conventional approach. However, the game approach should be considered as a valuable supplementary teaching method since the students motivation was evident (Ashmun, 1966).

In a study of the use of problem solving in teaching basic business courses, Cleveland noted that problem solving involves the students' sense of urgency and curiosity, and probably as a result of this involvement, the method is quite effective (Cleveland, 1966).

Sloan investigated an application of the micromolar behavior theory to the teaching of beginning Gregg shorthand. The traditional method proved more effective during the early weeks of the course, but over the long run, the experimental method seemed as effective as the traditional method (Sloan, 1967).

Speed goals seem to be ineffective in motivating students to achieve higher speeds in beginning high school typewriting classes. Anderson detected no difference in the speed achievements of students who set speed goals and students who did not set speed goals (Darlene Anderson, 1966).

IMPLICATIONS: Teaching aids, which may prove helpful to other teachers in the same teaching areas, have been developed and evaluated in the areas of fluid power, digital computers, plastics, economics, and drafting. The studies on teaching materials may provide help in choosing materials in certain areas:

home economics textbooks were evaluated, a list of free and inexpensive materials was provided for the business education field, and a superior enamel finish is named in one study. Educators should check the studies on teaching methods if interested in any of the following methods: Radio, educational films, information sheets, auto-instructional programs, the game approach to teaching business problems, problem solving in basic business courses, the micromolar behavior theory applied to the teaching of shorthand, or speed goals in typing. One study which provides a framework for research in industrial arts motor learning may prove helpful to other researchers.

E. Career Development

Studies of Relationships Useful in Prediction of a Criterion:

Schmidt examined the relationship between the number of farm visits made by the vocational agriculture instructor and the labor income from the student's supervised farming program. He found a high degree of relationship between the number of farm visits per boy and labor income from the boy's farming program. It was concluded that the number of farm visits with a boy is a significant predictor of that boy's labor income in his farm program (Schmidt, 1965).

In an investigation of the relationship between the labor income from the supervised farming program and establishment in farming, Rix concluded that the supervised farming program plays an important role in the establishment of young men in farming. He felt the supervised farming program gave the young men the knowledge and confidence needed to make the decision to become farmers (Rix, 1966).

A farmer's success is related to his educational investment, according to a study by Persons. It was found that "years of education" was a significant predictor of farm success when success was measured by the criterion of "yearly gain in net worth". The study also indicated that "net income" is not a good criterion of success for the farmer (Persons, 1966).

Kittleson investigated "The Relationship Between Selected Psychological, Sociological, and Personality Measurements and Achievement in a College of Agriculture". The study indicated the four most useful predictors of grades in a college of agriculture to be (a) ACT mathematics standard scores, (b) high school rank, (c) family relationships scale on the Minnesota Counseling Inventory, and (d) conformity scales on the Minnesota Counseling Inventory (Kittleson, 1966).

In a study of the causal relationships between experience in industrial arts and grades earned in a post-high school trade and technical curriculum, Moss discovered that industrial arts experience did not make any special contribution to success in post-high school trade and technical courses. The study suggests, as one possible reason for this situation, that students taking industrial arts often take less academic subjects, such as the physical sciences and foreign languages (Moss, 1966).

Dunn identified certain variables useful in "Predicting First Year Grade Point Averages of Students In the Industrial Drafting and Design Technology Department At The North Dakota State School Of Science". He found that the

best predictors were the scales: Mechanics, and Patterns scales of the Flanagan Aptitude Classification Tests, and the Mathematics, Science, English, and Social Studies scales of the American College Testing Program (Dunn, 1967).

A study by Nelson revealed that there are no relationships between any combination of the variables (a) creativity, (b) intelligence, (c) a rating of cooperation when creativity is measured by the "Minnesota Tests of Creative Thinking, Abbreviated Form VII", (d) IQ taken from school records, and (e) cooperation measured by teachers using a graphic rating form. The study indicates that "creative" individuals are neither more or less cooperative than "intelligent" individuals (John Nelson, 1965).

In an investigation of "Home Management Students' Values In Managing a Home as Related To Selected Family Background Factors", Croswell found that the girl's strength of value in the social area to be negatively related to parents' participation in social service type activities. The girl's strength of value in the intellectual area was directly related to the number of books in the home (Croswell, 1966).

Wilkosz conducted "An Investigation Of The Relationship Between Creative Thinking Ability, Conjugal Power Structure and Intro-Family Support". The study seemed to indicate that creative adolescents come more frequently from families which are moderately mother-dominant and not overly supportive of their children (Wilkosz, 1965).

Studies Evaluating Guidance Services And The Services Of The School In General:

In a survey of the guidance program at Aitkin High School, Aitkin, Minnesota, MacDonald indicated that the program was considered effective by the students, and found "overwhelming" support for the practice of arranging contacts for seniors with colleges and other school representatives (MacDonald, 1966).

Hasselfeldt conducted a follow-up study of the 1960 graduates of Staples High School, Staples, Minnesota. The study indicated the students were generally well pleased with the guidance services, but would have liked more instruction in marriage preparation, family living and sex education. The responses of the graduates indicated that the guidance counselor should be employed during the summer months to help graduates with educational and vocational planning (Hasselfeldt, 1966).

In a follow-up study of the former students of Cotton High School, Cotton, Minnesota, Esterberg revealed that most former students find unskilled jobs and do not continue their education. The study appeared to indicate the need for more vocational guidance and counseling (Esterberg, 1965).

Babcock did a follow-up study of the class of 1960 of Mound High School, Mound, Minnesota, five years after graduation. He found that only a small portion of the students had been able to make satisfactory vocational choices before high school graduation, and most of them seem unhappy with their present jobs (Babcock, 1965).

IMPLICATIONS: In the area of vocational agriculture, studies lend support for continuing the supervised farming program and point out more frequent farm visits

as a means for strengthening this program. Education beyond high school would be beneficial for most young farmers. Industrial arts courses should probably not be taken if this means slighting the academic courses, since the academic courses appear to be at least equally useful in later vocational training. A set of variables has been identified for those interested in predicting success in industrial drafting and design courses. Home economics studies have identified certain family characteristics related to a girl's creativity and her set of values. The follow-up studies indicate that most guidance programs are serving students well, but there seems to be a need for more of it. Administrators might consider the suggestion of one study to provide extra guidance services to students by employing the guidance counselor during the summer months.

F. Organization and Administration

Bailey and Moss attempted to discover which of three mail techniques was most effective in stimulating interest in occupational education research. The three techniques consisted of mailing to teachers in occupational education in Minnesota one of the following: (a) A bibliography of occupational education studies being proposed, in progress, or completed since 1963 by researchers in Minnesota, (b) a list of occupational education problems and problem areas considered significant by a group of prominent educational leaders in Minnesota, or (c) both the bibliography and the problem list. The study showed the problem list to be more effective than the bibliography as an overall method for stimulating interest in research. The combination of problem list and bibliography seemed to be more effective in schools where administrators have an indifferent attitude toward research (Bailey, Moss, 1966).

In a study designed to provide "Information For Teaching Safety to Co-op Student-Trainees In Hopkins, Minnesota", Olson found repeated accidents to be a major cause for terminating the employment of a worker. The study indicates a definite need for more safety education since most unsafe acts were attributed to inexperience, inattention, taking chances, or bad judgement. The attitudes of workers toward safety were found to be closely related to the number of accidents (Ronald Olson, 1966).

Johnstone attempted to discover whether or not modular flexible scheduling has an effect, either negative or positive, on distributive education. He discovered that a large majority of administrators supported the idea of distributive education in a modular, flexible scheduled high school. Coordinators were enthusiastic in their support of the plan and students functioned fairly well in the schedule. Johnstone felt this type of scheduling should encourage continued growth of distributive education and allow smaller schools to add distributive education to their programs (Johnstone, 1965).

Persons applied automatic data processing equipment to the analysis of farm and home business records. The computer printed records proved to be more acceptable to farmers and more reliable, accurate, and uniform than hand kept records. The only problem seemed to be human error in recording the data, and it was believed that this source of error would greatly diminish as recorders became more familiar with the recording forms (Persons, 1965).

Andersen's study of advisory groups in adult homemaking programs provided information on the status, compositions, and functions of adult homemaking advisory groups in Minnesota. The study revealed that many home economics teach-

ers do not understand and exploit the unique contributions advisory groups are able to make (Rose Andersen, 1967).

IMPLICATIONS: Studies on organization and administration have (a) identified an effective mail technique for stimulating interest in occupational education research, (b) indicated the need for more safety education for cooperative work-study students, (c) revealed the acceptability of modular, flexible scheduling for distributive education, (d) indicated the desirability of utilizing automatic data processing equipment for analyzing farm and home business records, and (e) emphasized the need for a better understanding and utilization of adult homemaking advisory groups.

G. Staffing

Pucel, Smith, Hahn, and Bailey attempted to estimate the "Human Resources for Research In Occupational Education In Minnesota". They disclosed a lack of motivation of people in occupational education toward participation in research activities. In addition, they reported that only about half of the educational administrators in the state had "supportive" attitudes toward research in occupational education (Pucel, Smith, Hahn, and Bailey, 1966).

In a study of the preparation of distributive education teachers in economics, Meisner found the economic understanding achieved by students is not related to the amount of economic preparation of their teachers (Meisner, 1966).

Hansen compared the teaching behaviors of creative and less creative basic business teachers. The teachers were ranked "creative" and "less creative" according to their scores on the Test of Imagination, Form DX, Minnesota Tests of Creative Thinking. The study revealed that creative teachers accepted more of the pupils' ideas, lectured more, and used more examples designed to make the students think. The less creative teachers gave more directions, and accepted more periods of silence and confusion (Hansen, 1967).

Murphy investigated teacher personality as it related to teaching effectiveness in terms of influence on pupil development, specifically in the area of student independence. She noted that teachers who preferred complexity in thinking also preferred independence in students, and that teachers who preferred simplicity in thinking preferred dependence in students (Murphy, 1967).

Kendall did "A Study of the Relationship Between the Authoritarian Conceptual System of Student Teachers and Their Use of Information in Forming First Impressions of Students". She found that authoritarian student teachers approved of submission to authority (in students), but non-authoritarian student teachers approved of interdependence in relation to others (Kendall, 1966).

In a study of "Dogmatism As Related To Accuracy Of Student Teachers' Judgement Of Students", Hart discovered there was no significant differences in the accuracy of judgement of values held by students among teachers with low, medium, or high levels of dogmatism (Hart, 1966).

"Profiles of Minnesota Day School Trade and Industrial Teachers in the Area Vocational Schools" by Ernst provided a comprehensive picture of the personnel

that make up the instructional staff in the day trade program. The study indicated that many of the teachers have less trade experience than required by the state for certification. It was found that most teachers have a difficult time gaining further trade experience in the summer because they are studying, teaching, working to supplement their income, or are unable to find part-time work in their field. Nearly forty percent of the teachers had no teacher training before beginning in the vocational trade program (Ernst, 1965).

Thell conducted a study to identify desirable characteristics of agriculture instructors in Minnesota. He found that both superintendents and principals placed the highest value on "a well organized program of work". Other characteristics rated highly included abiding by agreements, respecting school regulations, moral standards, and a belief in vocational education in agriculture. Respect for students was ranked the most important classroom trait (Thell, 1965).

IMPLICATIONS: Recent staffing studies indicate (a) there is a lack of motivation toward research activity in occupation education, (b) many Minnesota day trade and industrial teachers lack the trade experience required by the state, and have a difficult time obtaining this experience after they begin teaching. Other studies in this section have provided insights about various characteristics of teachers and the relationships of teachers with students.

H. Program Evaluation

Thatcher conducted a study to determine the effectiveness of the consumer economics course at John Marshall Senior High School, Rochester, Minnesota. He concluded that the course provided the students with better economic understandings than they could have gained through day-to-day experiences outside the classroom (Thatcher, 1966).

Nelson's study of "Students' Attitudes Toward Selected Personal Finance Topics" was designed to evaluate the effectiveness of a course in consumer education. The study revealed a significant change in attitude toward the four personal finance topics studies as a result of the course (Keith Nelson, 1966).

In a survey of the office machines in use in the Minnesota Area Vocational-Technical Schools, Safratowich found the ratio of students to machines allowed good economy and efficiency in most of the schools. The study suggested that demonstrations by office machine companies offered an excellent means for supplementing the curriculum and exposing students to equipment not otherwise available to the school (Safratowich, 1967).

In "A Subjective Evaluation of the Two-Year Post-High School Marketing Curriculum in Wisconsin", Henkel found graduates well satisfied with the program as a whole, but about one-third of the graduates indicated dissatisfaction with the occupational information provided them. Most of the graduates had little difficulty obtaining employment after completing the course and about half of the graduates received additional training after completing the marketing program (Henkel, 1965).

Anderson attempted to determine if those individuals who hold the American Farmer Degree are different from other people once they have become established

in life. He found the criteria used to select individuals for the American Farmer Degree does select persons who continue to demonstrate their abilities later in life. He concluded that the selection criteria are reliable predictors of future performance and should be accepted as accurate predictors (Eugene Anderson, 1966).

Clinger evaluated the Student Craftsman's Fair Program in Minneapolis. He concluded that the objectives of the fair were being reasonably well satisfied. Most industrial education teachers supported the idea of the program, indicating they felt the exhibit had little affect on their own attitudes but that administrators had been favorably affected by it. The study indicated that the event needs more publicity (Clinger, 1965).

In a survey to evaluate audio-visual equipment at the University of Minnesota, Cherrier found the University to have adequate amounts and kinds of equipment, but it needs to promote the use of the equipment (Cherrier, 1965).

Rannells attempted to determine what should be included in a Master's degree program in Agricultural Education. As a result of a survey of the Agricultural Education chairmen in fifteen universities in the central United States, he came to the following conclusions: Courses should be included in off-farm agricultural occupations, international agricultural education, principles of vocational and technical education, curriculum and course planning in vocational and technical education, and statistical research methods. In addition, the liberal and general phase of agricultural education in graduate programs needs to be revised to increase the effectiveness of the Master of Agriculture Education as a thinker and as a scholar (Rannells, 1966).

IMPLICATIONS: Studies in this section have evaluated programs in the following areas: (a) Consumer economics, high school level, (b) two-year post-high school marketing curriculum, (c) vocational-technical school business machines, (d) the American Farmer Degree program, (e) the Student Craftman's Fair program, (f) the audio-visual equipment program at the University of Minnesota, and (g) Master's degree programs in Agricultural Education. Educators interested in these areas might check the particular studies for further information.

RECOMMENDATIONS

This report was prepared with the hope that recent, relevant research in the area of vocational, technical, and practical arts education might be brought to the attention of interested educators, administrators, and researchers. Studies were summarized under eight topics designed to help readers locate studies most relevant to their interests. These studies provide a great number of findings which should prove helpful to educators in the area in which the research was conducted. An overall look at the research suggests that there are not many common findings which could be used as a basis for generalizing the results of the studies to broader situations. Future research might be of greater value in improving education programs if some means were found for coordinating it, in order to bring the efforts of a number of researchers to bear on a common problem.

On the basis of this review and summary, and the finding of an apparent lack of coordination in the research being undertaken by vocational educators/researchers, the following recommendations seem to be in order:

a) Researchers must become more aware of the broad problem areas which are generally thought to be relevant in the Upper Midwest Region.
b) The number of problem areas identified in the region which remain as impending problems, with little research directed to them to date, suggest the need for more adequate numbers of researchers and developers, and the need for schools to assist in this regard by making more time available to their interested and competent staff for purposes of conducting research.
c) The often specific, immediate and local concern of educators/researchers must be expanded. Local problems are seldom unique to one school or school district. Viewing the problem in a broader context will lead to a mutual concern for a problem area and contribute to a more coordinated attack on the problem.
d) Vital to the accomplishment of the foregoing recommendations is the obvious and extremely important need for the dissemination of the results of research. Any attempt at coordinated effort among researchers is doomed to failure if the findings of research studies are not reported and if the reports are not generally available and easily accessible to other interested researchers.

Copies of research reports should be sent to the Minnesota RCU for cataloging and inclusion in the research library. This depository is the most convenient and most readily available source of vocational-technical research documents in Minnesota. If additional copies of research reports can be sent to the ERIC Clearinghouse for Vocational-Technical Education at the Ohio State University, this will provide the opportunity for their review and possible inclusion in the ERIC system for national dissemination.

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